HW2

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1 HW 2: Context-Free Languages

1.1   Problem 1

- Using the pumping lemma, show that the language $\{w|w$ is not a palindrome$\}$ is not regular. Hint: we know that the regular languages are closed under complement.

- Give a CFG for the language $\{w|w$ is not a palindrome$\}$ (let Σ be $\{0,1\}$)

- Convert the CFG from the previous part into a PDA that decides the same language

1.2   Problem 2

The languages $\{0^s1^s2^t|s,t \geq 0\}$ and $\{0^s1^t2^t|s,t \geq 0\}$ are context-free.

- Write CFGs for each of them

- By taking the intersection of these two languages, show that the context-free languages are *not* closed under intersection. Use the context-free pumping lemma

- Use the result of the previous part and DeMorgan's Laws to show that the context-free languages are *alos* not closed under complement.

1.3 Problem 3

Write a context-free grammar for { w | w is a palindrome } that is in Chomsky Normal Form. Hint: it might be easiest to make the simplest possible grammar and then *transform* it into CNF.

1.4 Problem 4

Prove that if a G is a CFG in Chomsky Normal Form then for any non-empty string $w \in L(G)$ of length n then exactly $2n - 1$ steps are required to derive w. You don't have to prove this with induction, just give an argument based upon the restricted structure of Chomsky Normal Form. As a side note, we'll come back to this result much later in the course.